

**REPUBLIC OF SOUTH SUDAN
MINISTRY OF HEALTH**



**SOUTH SUDAN ANTENATAL CLINIC SENTINEL
SURVEILLANCE FOR HIV AND SYPHILIS**

2012

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Acronyms

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal Care
DBS	Dried Blood Spots
CDC	US Centers for Disease Control and Prevention
CPA	Comprehensive Peace Agreement
CI	Confidence Interval
ELISA	Enzyme-Linked Immunoabsorbent Assay
GoSS	Government of South Sudan
HIV	Human Immunodeficiency Virus
LRF	Laboratory Request Form
MCH	Maternal and Child Health
MoH	Ministry of Health
PMTCT	Prevention of Mother-to-Child Transmission
QC	Quality Control
RPR	Rapid Plasma Reagin
SHHS	Sudan Household Health Survey
SAC	State HIV/AIDS Commission
SSAC	SouthSudan HIV/AIDS Commission
SS	Sentinel Surveillance
SSF	Sentinel Surveillance Form
SSS	Sentinel Surveillance Site
STI	Sexually Transmitted Infection
UAT	Unlinked Anonymous Testing
UNAIDS	Joint United Nations Program on HIV/AIDS
UNGASS	United Nations General Assembly Special Session on HIV/AIDS
UNICEF	United Nations Children’s Fund
VCT	Voluntary Counseling and Testing
WHO	World Health Organization

Foreword

The Republic of South Sudan has just gotten its Independence, after decades of civil war that has left over 2 million dead and utter destruction of the basic infrastructure – especially health care ones.

As development agenda is currently being undertaken by all arms of the government and with the support of partners, HIV response remains key area that all stakeholders need to address alongside other basic needs.

Studies to estimate the prevalence of HIV in South Sudan were conducted in 2007, 2009 and now 2012 to provide a better picture of the situation in the country. The above three rounds were conducted using ANC sentinel surveillance – targeting women receiving antenatal care services across the country.

This round of ANC Sentinel Surveillance estimated the prevalence of HIV and Syphilis as 2.6% and 8.3% respectively. The estimates do not significantly differ from the 2009 Survey which recorded HIV and syphilis rates 3.0% and 9.9% respectively.

The Ministry of Health of South Sudan is committed to continuously undertake this kind of study, in order to follow trends among this population group while working hard with South Sudan HIV/AIDS Commission (SSAC) and HIV Partners to conduct population based surveys that will give the true picture of the epidemic nationwide and among the different age groups.

This survey results therefore can be quoted by all institutions, noting the limitations of ANC surveillance in its use to provide population estimates.



Dr. Makur M. Kariom
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Key findings

- HIV prevalence among pregnant women participating in the 2012 Antenatal Care Sentinel Surveillance (ANC SS) round was 2.6% (95% CI 2.3, 2.8). Although it was not possible to determine trends in HIV prevalence among pregnant women participating in ANC SS over the three rounds conducted between 2007 and 2012, this represents the lowest level of HIV infection ever reported for ANC SS since the first round of SS in 2007.
- Major variations were observed in the distribution of HIV prevalence amongst the diverse geographic regions ranging from the highest prevalence of 6.8% in Western Equatoria State to the lowest prevalence of 0.3% in Northern Bahr El-Ghazal.
- At the site specific level, Ezo reported the highest prevalence of HIV infection at 14% followed by Yambio and Tambura at 8.4% and 6.5% respectively. Gokmachar and Kwajok reported the lowest prevalence of HIV infection at 0% followed Katigiri at 0.1%.
- The main correlates of HIV infection are; marital status, Level of Education and gravida. Compared to those with one pregnancy, women with two pregnancies were almost twice more likely to have HIV infection (Odds Ratio, OR [95% C.I], p-value: 1.8 [1.2 – 2.6], $p < 0.001$). Women with elementary education, when compared to women with no formal education were half as likely to have HIV infection (Odds Ratio, OR [95% C.I], p-value: 0.5 [0.4 – 0.7], $p < 0.000$).
- Overall syphilis infection prevalence from the 2012 surveillance survey was 8.3%, 95% CI [7.7-8.7].
- The main correlates of syphilis infection are; residence (urban/rural), marital status, level of education and gravida. Compared to those with elementary education, women with no formal education were almost twice more likely to have syphilis infection (Odds Ratio, OR [95% C.I], p-value: 1.9 [1.6 – 2.3], $p < 0.001$).

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1.0 Introduction

HIV/AIDS continues to present a major public health challenge in Sub-Saharan Africa (SSA) where the epidemic is home to an estimated 23.5 million people – around two thirds (69%) of people living with HIV globally [1]. In an attempt to monitor trends in the epidemic and provide information on the effectiveness of preventive and control measures, the World Health Organization (WHO) recommends national HIV surveillance programmes [2].

Sentinel Surveillance (SS) programmes conducted in Antenatal Clinics (ANC) have been used by governments and development partners to plan and monitor national HIV response. These programmes have become standard data elements for national projections and international reporting. In some countries, such as South Sudan lacking better population-based data sources, data from pregnant women attending ANC is used to produce proxy estimates of general population prevalence [3]. Not only are pregnant women considered a good proxy for the general population, they are also fairly easy to access: most use antenatal clinic (ANC) services during their pregnancies and, in that context, blood may be drawn for routine testing.

With the signing of the Comprehensive Peace Agreement (CPA) between North and South Sudan in January 2005, 22 years of civil war in southern Sudan officially ended. Since then, the focus of health planning has shifted from relief to development. The return of refugees and (Internally Displaced Persons) IDPs from surrounding countries including Ethiopia, Kenya, Uganda, Democratic Republic of Congo, Central African Republic and Republic of Sudan has increased the risk of HIV transmission in South Sudan. Kenya's prevalence is estimated at 6.3%, Uganda at 6.5%, and 4.7% in the Central African Republic (UNAIDS estimates). The 2009 ANC survey in South Sudan yielded an HIV prevalence of 3.0%.

Other effects of peace—increased trade and commercial activities across borders (especially increased traffic of trucks and other vehicles along the trans-African highway), reconstruction and rehabilitation activities, and relative peace and affluence coupled with cultural, religious and tribal traditions—have also increased the risk of HIV transmission.

The need for HIV prevalence data in South Sudan is acute. A national sero-prevalence survey for HIV has been conducted and the results are yet to be released. This will produce both behavioral and biological results which will be used to enhance the understating and response to the epidemic in the newest country in Africa.

The Government of South Sudan is making a lot of efforts to strengthen the HIV surveillance system and generate data for advocacy, planning, and control of HIV.

The health infrastructure of South Sudan remains rudimentary and fragmented. Decades of neglect and years of devastation from wars have contributed to poor health status of South Sudanese. Rates of access to antenatal and obstetrical care are among the lowest in the world. Data from the 2006 Sudan Household and Health Survey revealed that south Sudan has the highest maternal mortality rate in the world (2,054 per 100,000 live births) and also one of the highest child mortality rates (135 per 1,000 live births) globally. The quality of maternal and child health (MCH) care available is below acceptable standards.

In this ANC survey, collection of surveillance data was linked to the provision of routine services to antenatal clients. Conditions and severely limited human and financial resources in South Sudan, however, make it difficult to quickly expand coverage of PMTCT services in many parts of the country. The data obtained from ANC sentinel surveillance will be used by key stakeholders to make strategic decisions pertaining to the use of limited resources for scaling up these and other HIV-related services.

1.1 Background

Population estimates for South Sudan vary widely between 7.5 and 12 million. This population resides in an area larger than Kenya, Burundi and Rwanda combined. The people of South Sudan are considered among the poorest in the world, despite the presence of significant natural resource wealth.

The dire effects of the HIV epidemic in much of sub-Saharan Africa are well-known, but HIV prevalence data in South Sudan remain sparse. Limited data suggest overall rates lower than in neighboring countries, and it has been suggested that war may have had a protective effect against the spread of HIV. Whatever the effects of war on the spread of HIV, the conditions of a generalized HIV epidemic now exist in many parts of South Sudan, and concentrated epidemics are likely throughout the country. Rates appear to be substantially higher in parts of South Sudan bordering countries with relatively high prevalence rates compared to more isolated areas in the interior, although data are far from complete. In 2002, a community-based sero-prevalence study showed the HIV sero-prevalence rate in Yei, near the DRC and Uganda border, to be more than ten times higher than in Rumbek, located inland around the center of South Sudan (4.2% vs. 0.4%; unpublished data, CDC). Some alarming program data have also been reported recently from Tambura in Western Equatoria state located near the Central African Republic border. Between January and June of 2008, a VCT site there reported 17% of all clients (12% of males and 21% of females) tested HIV positive.

The few surveys of HIV-related knowledge, attitude, and practices conducted to date in South Sudan have demonstrated that levels of awareness and knowledge of HIV are low while behaviors often associated with increased risk of HIV and STI transmission are relatively common. Data from the 2010 South Sudan Household Health Survey (SHHS II) shows that only 8.6 percent of women aged 15-49 years in South Sudan have knowledge about HIV prevention (defined as correctly identifying two ways of avoiding HIV infection), and only 15 percent have awareness about mother-to-child transmission of HIV.

Rapid increases in HIV incidence are possible under conditions such as above. While the end of conflict should make possible the development and provision of social services, it is generally

believed that peace may also create conditions conducive to the spread of HIV, as increased trade, transport, and travel, including potentially large population movements and return of refugees, are occurring.

The South Sudan HIV/AIDS Commission (SSAC) and the Ministry of Health (MoH) recognize that the establishment of surveillance systems is critical to collect, analyze and disseminate accurate up-to-date information on the prevalence of HIV in order to guide planning for prevention and care programs, policies formulation and programs evaluation and advocacy. Sentinel surveillance in antenatal clinic sites remains a standard method for monitoring prevalence of HIV throughout much of the developing world. Prevalence in women presenting for antenatal care (ANC) often reasonably approximates HIV prevalence in the reproductive-age population, although other data sources should be used to help validate ANC clinic surveillance data. Sentinel surveillance in other populations, including patients with sexually transmitted infections (STIs), can provide prevalence data specific to that population, as well as more general information about sexual health.

Unlinked anonymous ANC surveillance data collected since late 2005 has many limitations, but clearly demonstrate important local variations. Prevalence data from the 2007 and 2009 ANC surveys are depicted in Table 1 below. Some additional data from ANC populations are available from PMTCT programs in Yei, Maridi, Rumbek and KajoKeji, in which all pregnant mothers are supposed to be offered HIV testing as a routine component of antenatal care. An “opt-out” counseling and testing (CT) strategy is used, and experience in these areas has demonstrated that when this CT model is appropriately delivered the acceptance rate is very high. Since PMTCT and ANC sentinel surveillance began at St. Bakhita HC in Yei in 2005, the rates of HIV in pregnant women in the PMTCT program have been similar to the rate obtained by unlinked anonymous testing. Additionally, in Rumbek, 6,802 women have been tested routinely in ANC since 2005 with 64 (0.94%) positive for HIV, a rate not significantly different than the ANC rate reported in 2003.

Table 1: HIV prevalence among ANC attendees in the 2007 and 2009 ANC surveys

	2007			2009		
	Number tested	Number HIV+ (%)	95% Confidence interval	Number tested	Number HIV+ (%)	95% Confidence interval
Awiel Civic Hospital (U)				299	0 (0.0%)	---
Cueibet PHCC (R)	107	1 (0.9%)	0.02 - 5.1%	300	1 (0.3%)	0 – 0.98%
Akobo PHCC (R)	110	1 (0.9%)	0.02 - 5%	169	1 (0.6%)	0 – 0.7%
Kuajok PHCC (U)				289	2 (0.7%)	0 – 1.6%
Renk Civic Hospital (R)				216	2 (0.9%)	0 – 2.2%
Torit Civic Hospital (U)				298	4 (1.3%)	.03 – 2.7%
Wau Teaching Hospital(U)				299	4 (1.3%)	.04 - 2.6%
Bentiu State Hospital (U)				296	4 (1.4%)	.04 - 2.7%
Rumbek PHCC (U)				300	5 (1.7%)	0.2 - 3.1%
Leer – PHCC (R)	874	7 (0.8%)	0.3 – 1.6%	135	3 (2.2%)	0 - 4.7%
KajoKeji Civil Hospital (R)	1045	17 (1.6%)	1.0 - 2.6%	264	6 (2.3%)	0.5 – 4.1%
Maridi PHCC (R)	244	14 (5.7%)	3.2 - 9.4%	250	6 (2.4%)	0.5 – 4.3%
Boma PHCC (R)	429	31 (7.2%)	5.0 - 10.1%	159	4 (2.5%)	.08 – 5.0%
Bor Civil Hospital (U)				300	8 (2.7%)	0.9 – 4.5%
Malakal Hospital(U)				265	8 (3.0%)	1.0 – 5.1%
St. Bakhitia PHCC (R)	792	21(2.7%)	1.6 - 4.0%	255	8 (3.1%)	1.0 – 5.3%
Malakia PHCC (U)				140	5 (3.6%)	0.5 – 6.6%
Bam PHCC (U)				169	6 (3.6%)	0.8 – 6.3%
Nyakuron PHCC (U)				300	12 (4.0%)	1.8 – 6.2%
Nimule PHCC (R)	492	11 (2.2%)	1.1 - 4.0%	249	14 (5.6%)	2.8 – 8.5%
Rumbek State Hospital (U)				283	16 (5.7%)	1.0 – 8.3%
Juba Teaching Hosp(U)				299	18 (6.0%)	3.3 – 8.7%
Pochalla PHCC	18	2 (11.1%)	*	---	----	----
Tambura PHCC (R)	599	69 (11.5%)	9.1 - 14.4%	250	19 (7.6%)	4.3 – 10.9%
Yambio Hospital (U)				129	20 (15.5%)	9.3 – 21.8%
Total	4,710	174 (3.7%)	3.2-4.3%	5,913	176 (3.0%)	2.6 – 3.4

Even with the limited data that have been collected to date, the greatest barrier to expanding HIV services and programs lies in the fact that South Sudan's severely limited financial resources have gone primarily toward building human capacity in the government and expanding offices of the GoSS in each state. This has meant little expansion of PMTCT or VCT programs since 2005 besides those programs sponsored by international NGOs and other partners. South Sudan PMTCT guidelines call for pregnant women who do not "opt-out" to receive HIV and syphilis testing as a routine part of antenatal care. Rapid HIV tests are used in PMTCT programs according to nationally-approved algorithms. Post-test counseling emphasizing prevention of vertical transmission and safer sex are being provided according to national guidelines. Nevertheless, few women are able to benefit from PMTCT services in South Sudan because the services do not exist in most parts of the country. This is primarily due to poor infrastructure and limited human and financial resources. ANC surveillance from sites with access to PMTCT services is the ideal, but in the absence of that, data will be collected from populations that have access to basic ANC services.

The expansion of PMTCT services will take more than increased funding. The limited number of qualified Nurses, Midwives, Laboratory Technologists and Technicians, and other health professionals in the country severely hampers efforts to expand PMTCT and VCT services. Additional HIV data from ANC surveys and bio-behavioral surveys among MARPS will support Government of South Sudan efforts to advocate for funds from both the government and international agencies such as the Global Fund and PEPFAR to build health capacity and infrastructure, scale up service delivery, and expand access to services.

2.0 Objectives

The overall objective of the 2012 South Sudan National HIV and syphilis prevalence survey through the ANC SS was to monitor the epidemic and provide HIV prevalence data for planning, monitoring and evaluation of HIV and AIDS response activities.

Specific objectives included:

1. To estimate the HIV and syphilis prevalence among pregnant women aged 15-49 attending antenatal care in South Sudan
2. To understand the geographical spread of HIV infection and to identify emerging pockets.
3. To better understand and monitor the trends of the HIV epidemic among pregnant women and the general population of different states.
4. To provide information for advocacy, programs planning and programs evaluation

3.0 Methods

3.1 Sampling

Selection of Sentinel Population

This survey was conducted as an unlinked anonymous survey amongst women aged 15 – 49 years who attended public antenatal health services for the first time during their current pregnancy. These women were used as target population as they are sexually active; constitute an easily accessible and stable population, and are more likely than any other groups to be representative of the general population. In addition they obtain antenatal care at facilities that draw blood as part of routine medical services offered to this group.

Selection of Sentinel Sites

The 2012 SS round was conducted among pregnant women attending 35 ANC designated facilities distributed over the ten States, representing a substantial amount of the cultural, socioeconomic and regional diversity within South Sudan. Selection of the sites was as a result of consultation between the Ministry of Health (MoH), the South Sudan HIV/AIDS Commission (SSAC), and partners including World Health Organization (WHO). As a result, all the sites that

were used for the 2009 survey were selected, while an instrument (Appendix 1) was developed for assessment of additional sites.

A site was classified as 'urban/peri urban' when it is located in a state capital or a town with an estimated population of at least 50,000 inhabitants. Any site that did not fulfill the above criteria was considered 'rural'.

Factors for Sentinel Site Selection

Factors that were considered in selecting a site were the following: its location; the population of the catchment area; presence or absence of an ANC Clinic and PMTCT or VCT services; the number of total and first time visits to the ANC clinic in the three previous months (to look at attendance trends); availability of health care providers (especially doctors, medical assistants, midwives, nurses, and laboratory technologist/technicians); services provided at the ANC clinic to pregnant women; presence or absence of laboratory services and personnel; the level of training of the laboratory personnel; tests performed at the laboratories for ANC clinic clients (hemoglobin, syphilis, HIV, etc.); availability of space to store DBS specimens; and also the ability to ship specimens to the reference laboratory.

Sampling methods

Sample size, Sampling Period and Frequency

Sentinel Surveillance data collection is usually done every two to three years for three months at a time period set by HIV/AIDS division in the Ministry of health. The 2012 SS round was conducted between May and July 2012. Guided by WHO guidelines, the sample size per site was set 320. If a site achieved the site-specific maximum sample size of 320 in a period less than three months, data collection was stopped at that site. If a site had not achieved a minimum sample size within the three-month period for reasons beyond their control, the sampling period was extended by the number of days lost to ensure a minimum sample size was achieved. This extension did not exceed two weeks.

Client Eligibility Criteria

Inclusion criteria for pregnant women (15 – 49 years of age) attending ANC sentinel sites:

1. First ANC visit to the sentinel surveillance clinic for that pregnancy during which the woman is tested for syphilis.
2. Residence within the catchment area of the site
3. Clinic attendance during the sentinel surveillance period

3.2 Operational procedures

Staffing and training

Data collection forms were reviewed and updated to ensure that they captured the necessary data in a convenient and usable fashion, from a surveillance point of view. A training schedule with emphasis on proper handling of dried blood spots (DBS), proper identification of eligible clients, and proper documentation of the surveillance process was developed by the HIV/AIDS Division. Sentinel site staff, including two nurses and one lab tech from each site, were then identified and taken through an integrated three day training on SS including being provided feedback on prior site performance and final results of SS. The training course included orientation to basic facts and overview of HIV/AIDS, basics of ANC Sentinel Surveillance, overview of R2 ANC Surveillance of 2009, the survey sites –codes- sample size and period, surveillance procedures for abstracting demographic data, forms, data collection, client and specimen handling procedures, and for laboratory staff, practical sessions on standard preparation of DBS specimens and storage as well as handling of forms and specimens. Laboratory staff were also be trained in Bio-safety and Universal Precautions to reduce the chance of injury when working in the laboratory. HIV/AIDS Division and Reference Laboratory staff constantly reinforced the importance of complete and accurate recording of data during the training.

Data collection: Source Documents and Data Flow

A pregnant woman attending a selected ANC clinic during the sampling period was assessed by a clinician (nurse, or midwife) to determine if she is eligible for participation in the survey using the criteria mentioned above. Antenatal nurses/midwives collected routine demographic data on a standard “Laboratory Request Form” (Annex 3). Information captured on this form includes: year of birth, gravidity and parity, marital status, residence (payam and county) education level, 1st ANC Visit, offered PMTCT HIV testing and acceptance of PMTCT HIV testing.

The form was also used to request for other routine laboratory investigations which are part of ANC tests done for every pregnant women attending ANC. In ANC SS sites, routine ANC tests include hemoglobin and syphilis testing. Since this form was also used for other hospital laboratory requisitions, patients meeting the inclusion criteria for SS were identified if the form was labeled “1st visit” at the upper right hand corner.

In the laboratory, samples from patients meeting eligibility for SS underwent the routine tests as ordered. The ANC profile laboratory tests were performed and the results recorded by the laboratory technician on the “laboratory Request Form”. A laboratory technologist or /technician trained in SS then transferred the demographic information (without any personal identifiers), and the syphilis laboratory test results from the “laboratory Request Form” to the “ANC Sentinel Surveillance Form” (Annex 4). A serially created SS identification number was then assigned. The “ANC Sentinel Surveillance Form” was packaged in bound pads of 50 forms. These forms were in triplicates at all sites. One copy of “ANC Sentinel Surveillance Form” remained at the facility while the other copies accompanied the specimen to the HIV/AIDS division office and Reference laboratory. The “Laboratory Request Form” (with the lab results of the ANC profile) was then promptly returned to the clinic for provision of care.

Blood Specimen Collection and Laboratory Testing

After demographic and clinical information was collected, ANC attendees were directed by the clinic staff to the on-site laboratory for routine blood draw. Venous blood was collected in EDTA tubes from all ANC attendees for hemoglobin screening and syphilis testing, irrespective of their eligibility for the study. The client was then informed of these test results. If the syphilis test result was reactive, the woman was treated according to MOH and WHO guidelines. All eligible women who had blood drawn at the first antenatal visit for clinical laboratory testing were tested for HIV through unlinked anonymous testing (UAT). Leftover blood in the EDTA tubes was used to prepare dried blood spot (DBS) specimens on filter paper for UAT.

Surveillance forms were filled in for first time ANC attendees by the laboratory staff, including the syphilis test results. These forms were kept in a secure location until the end of the day.

Clinic staff collected the forms at the end of each day and put them in a locked file cabinet until the site supervisor collected them. The DBS specimens were sent to the Reference Laboratory in Juba for HIV testing using ELISA. The testing algorithm can be found in Annex 5.

The following steps were followed for the preparation and storage of DBS specimens:

1. Approximately two drops of venous blood leftover from routine ANC testing were placed on at least three of the five circles on the standard piece of filter paper.
2. Sentinel surveillance ID labels were placed on the filter paper and the surveillance form, including all carbon copies. Demographic data was transferred from the Laboratory Request Form (LRF) as described earlier.
3. The DBS was placed in a drying rack in a ventilated storage box and dried overnight in a dry, warm place.
4. After proper drying, each filter paper was inserted in a glycine storage bag and a commercial desiccant added to the bag. Ten filter papers were then placed in a zip lock bag, humidity indicator strip added and the bag sealed. Packaged in this way, the DBS were stored in secure location at ambient room temperature until they were collected and transported to the Reference Laboratory in Juba. Specimens were transported every 2-4 weeks.
5. Upon receipt at the Reference Laboratory in Juba and after testing was completed, the DBS specimens were stored frozen at -20°C for longer-term storage and possible future testing as required.

DBS Testing

Laboratory testing was conducted in the Reference Laboratory in Juba according to a WHO national guidance for ANC surveillance of HIV using dried blood spots:

1. After placing a 6 mm punch from a DBS in a microtitre U-well plate and eluting overnight, testing was performed with Vironostika HIV Uniform II plus O ELISA kit. This was the preliminary test.
2. All positive or threshold results were retested with Murex HIV 1/2 for confirmation.

3. All discordant samples were sent to the CDC laboratory in Nairobi for tie-breaker testing using PCR
4. The remaining DBS were stored at -20° C for possible future testing. No genetic testing was conducted on the specimens.
5. All positive or threshold results and 10% of HIV negative results were sent to CDC Atlanta for external quality assurance as described in the section “Quality Assurance” below.

Quality Assurance

The Ministry of Health in collaboration with the Reference Laboratory in Juba and partners were responsible for ensuring that the operations for the surveillance survey were performed according to the protocol and were held to national and international laboratory standards using strict quality control measures.

The following measures were taken to ensure staff competency:

1. All laboratory and ANC staff was trained in the survey procedures prior to the start of data collection.
2. On-sight monitoring was held during supervisory visits to the sentinel sites.
3. The ANC surveillance protocol was accessible to all survey staff at all sites.

Sites required frequent technical support and were visited regularly to monitor adherence to the survey protocol, changes in staffing or services, and other factors that could have affected their capability to collect quality surveillance data. Given the lack of job security, amenities, and facilities, change in personnel is common in South Sudan. A core group of officials from the MoH Division of HIV/AIDS/STI, SSAC, and CDC provided oversight of the surveillance activities. Official visited each site at least twice during the study and were responsible for collecting and transporting the DBS samples to the Reference Laboratory in Juba. A state supervisor was appointed to provide additional support and supervision.

The following measures were taken to ensure the quality of dried blood specimens:

1. DBS was stored for not more than 21 days (3weeks) at room temperature under 35°C or in refrigerator at 4°C.
2. Samples were screened by the Reference Laboratory through the eligibility check list.
3. All samples were accompanied to the Reference Laboratory in Juba by the DBS submission form. All forms had to match the registration number on the DBS. Samples more than 30 days old were rejected
4. Samples that were contaminated (packed together) were rejected
5. Samples were registered and kept in the refrigerator at - 20°C.
6. For each plate run, an in house DBS Positive Control was included.

External quality assurance (EQA) of the specimens was conducted at the CDC Atlanta laboratory. All positive specimens and 10% of negative specimens were sent to Atlanta for testing. Results were sent electronically to the Reference Laboratory in Juba. Of the total 1,370 specimens sent to Atlanta, 1,344 met specimen acceptability criteria for retesting including 285 positive specimens and 1,059 negative specimens. Of the 285 positive specimens, 252 were confirmed as true positives with a concordance of 89.1%. Of the 1,059 negative specimens, 1,056 were confirmed as true negative with a concordance of 97.0%. The overall agreement of all specimens was 97.3% which was within the EQA threshold of 95.0% for acceptability of the results.

Among the 30 specimens that tested as positive in the Reference Laboratory in Juba but were found by CDC Atlanta to not be true positives, 29 were false positives and one was indeterminate. EQA conducted in Atlanta used Genetic Systems HIV – 1/2 Plus O EIA (EIA) as the first test and Maxim Western Blot (WB) as the confirmatory test. Combined EIA/WB is the reference standard against which other assays are evaluated, and therefore the combined sensitivity and specificity of the assay is 100%. Per WHO/UNAIDS international guidance for HIV testing in ANC surveillance, the HIV laboratory testing in South Sudan used Vironostika HIV Uniform II plus O ELISA as the first test and Murex HIV 1/2 for confirmation, with a sensitivity of 100% and specificity of $\geq 99.5\%$. It was determined that the WHO guidance employing two

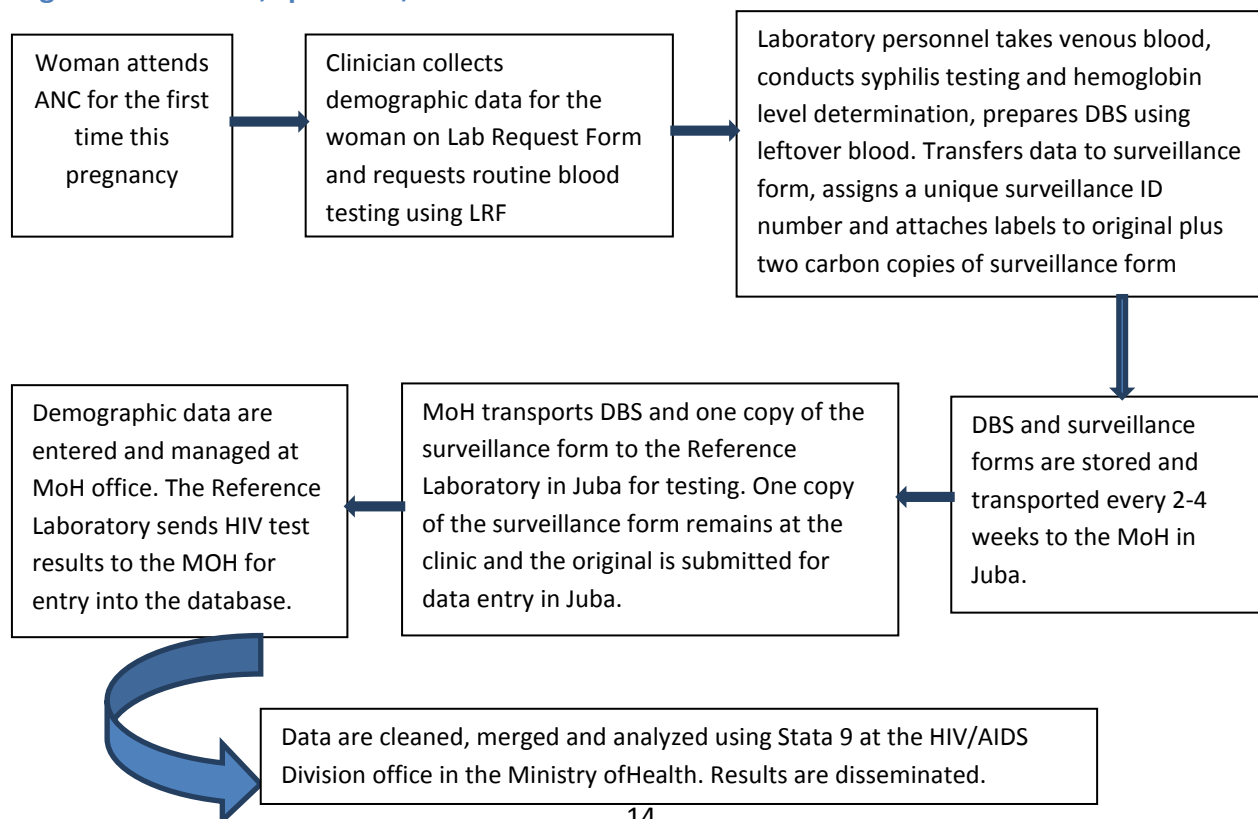
highly sensitive EIAs resulted in 10.3% of the 281 positive samples to be false positives during EQA.

ANC surveillance in South Sudan followed WHO guidance in both 2009 and 2011. These EQA findings from South Sudan indicate that the testing algorithm in the international guidance has resulted in a high percentage of false positives and therefore an overestimation of HIV prevalence. Because the same guidance was adhered to in both rounds, the same bias has been introduced into the measurement of HIV prevalence among ANC attendees. Therefore, while the exact numbers of positives in the analysis may be overestimated, the interpretation of trend results is accurate and has been reported based on the Reference Laboratory in Juba's. This accurately reflects the analysis and trends based on international guidance. A MOH-led committee will review these findings and provide recommendations for retesting the samples for 2009 and publishing revised HIV prevalence estimates and trends. This will also have implication for other countries using the WHO/UNAIDS guidelines.

3.3 Data management and data analysis

Data Management

Figure 3.3: Patient, specimen, and data flow at ANC surveillance sites



Data from “Laboratory request form” were transferred to the “ANC Sentinel Surveillance Form” at the sentinel site by a lab technician. These were remitted to the HIV/AIDS division office and Juba teaching hospital laboratory for central processing and data entry. Data entry was performed centrally using the national SS data entry screens in CSPro 4.1

HIV laboratory data including: sentinel surveillance ID number (from the filter paper); the date the test was run; optical density; cut-off and result for each ELISA test; confirmatory test dates and results (Western Blot, if done); and final HIV result (positive, negative, indeterminate, or missing) was electronically generated at the Juba Teaching hospital laboratory. Password-protected data bases were used for all the data systems. Data was cleaned, merged and analysis performed by a Consultant at the HIV/AIDS division, Ministry of health.

Data Analysis

Data analysis was guided and conducted according to the WHO recommendations [3]. Baseline Characteristics were stratified by site location and their frequencies (column percentages) summarized in a table. To describe the baseline distribution of continuous data elements, means, minimum and maximum were presented.

The overall prevalence of HIV and syphilis infection was determined as the number of participants testing positive for HIV or syphilis from the total number of participants tested in all the sentinel sites included in this round of surveillance. Site specific prevalence’s were also summarized in a table. 95% binomial confidence intervals were estimated for both overall prevalence and site specific prevalence. The prevalence of HIV and syphilis was also determined for different age groups, site location, marital status, levels of education, number of pregnancies and states. 15 – 24 years is also of public health interest as a greater proportion of these infections are more recent and may be used as an indicator of population incidence. Prevalence for this age group was also determined.

Logistic regression was used to analyze the data for correlates of HIV and syphilis infection. Odds Ratios (ORs), 95% confidence intervals and likelihood ratio tests (LRT) p-values were presented.

Cases with age below 15 years and with missing data on the status of HIV or Syphilis amongst participants may result to an underestimation or an overestimation of the overall prevalence and were excluded from the analysis.

All analyses were carried out using STATA statistical software (STATA Intercooled version 9.0, Stata Corp, College Station Texas, USA).

Interpretation and Dissemination of Results

Sentinel surveillance data is essential for monitoring the HIV epidemic in South Sudan. Findings of the surveillance will be shared widely with all partners and stakeholders so that the data can be used in program planning and making policy decisions. The data will be used to estimate national prevalence data. The Spectrum/Epidemic Projection Package (EPP) is a software system used for such purposes in many countries, and follows recommendations of the UNAIDS Working Group on Estimates and Projections.

Dissemination of results will be through;

- A press release of findings by the Ministry of Health and/or the South Sudan HIV/AIDS Commission
- A printed report for wide dissemination at HIV/AIDS stakeholders meetings organized by the Ministry of Health and South Sudan AIDS Commission (SSAC)
- An annual HIV Surveillance Report written for leaders and planners in the health sector that will be prepared by MoH, SSAC and partners
- Prevalence information will be used to inform media campaigns for HIV prevention and care, including VCT, PMTCT, and ART programmes.

Additionally, summary surveillance data will be shared with staff at the surveillance sites to inform them of the prevalence of HIV in the ANC population and continue to keep them motivated in carrying out such surveillance to measure trends over time. Surveillance data will also be used to educate the public, with the goal of enhancing prevention and utilization of HIV-related services.

To increase the probability of reaching the information and message to selected target groups, appropriate communication means like television, radio, newspapers, scientific journals, newsletters, press releases, presentations at seminars and conferences, etc. will be utilized. Efforts will be made to use this information to advocate for and initiate PMTCT programs in all ANC clinics in South Sudan.

3.4 Ethics

3.4.1 Confidentiality and Ethical approval

Anonymity of SS clients is essential. No information was collected that can link the surveillance ID number to personal identifiers. Since no HIV testing for SS was performed on-site and no personal identifiers were included in either the lab or demographic database; no staff at facilities or central lab or data processing locations, were able to identify any patient's results. To enhance confidentiality, database systems were also password protected. Summary results and laboratory quality assurance reports will be shared with sites, but no line listing or other database that could possibly be used to link results to patients will be provided to facility-level staff. Ethical approval to conduct this round of sentinel surveillance was provided by Ministry of Health (GoSS) ethics committee and CDC Atlanta (NRP Approval).

4.0 Results

4.1 Distribution of select characteristics among pregnant women

Overall, 99.6% (11,155/11,200) of the targeted sample size of pregnant women attending ANC care from the 35 selected sites were recruited into the 2012 round of SS in South Sudan. Overall, only 2 sites failed to achieve the targeted sample size of 320 participants. This was mostly due to low client flow.

Table 4.1: Distribution of characteristics of women participants in the 2012 ANC SS (N=11,155)

Variables	Categories	Frequency [%]		
		Urban/Peri-Urban	Rural	Total
Age (Years)	Mean [Min-Max]	24.3 [15-45]	25.3 [14-46]	24.9 [14-46]
Age group	<15		6 [0.9]	6 [0.1]
	15 – 19	960 [21.4]	1201 [18.0]	2161 [19.4]
	20 – 24	1399 [31.2]	1845 [27.6]	3244 [29.1]
	25 – 29	1313 [29.3]	1916 [28.7]	3229 [28.9]
	30 – 34	559 [12.4]	1139 [17.1]	1698 [15.2]
	35 – 39	210 [4.7]	468 [7.0]	678 [6.1]
	40 – 44	17 [0.37]	86 [1.3]	103 [0.9]
	>45	4 [0.08]	9 [0.1]	13 [0.1]
	Missing	18 [0.4]	5 [0.1]	23 [0.2]
Marital Status	Single, Never married	422 [9.4]	634 [9.5]	1056 [9.5]
	Married , monogamous	3064 [68.4]	4193 [62.8]	7257 [65.1]
	Widowed	46 [1.0]	40 [0.6]	86 [0.8]
	Married, polygamous	912 [20.4]	1776 [26.5]	2678 [24.0]
	Divorced or separated	36 [0.8]	41 [0.6]	77 [0.7]
Level of education	No formal Education	2362 [52.7]	4199 [62.9]	6561 [58.8]
	Elementary School	1459 [32.6]	2070 [31.0]	3529 [31.6]
	High School	532 [11.9]	370 [5.5]	902 [11.9]
	College/University	121 [0.5]	31 [0.5]	152 [1.4]
	Missing	6 [0.1]	5 [0.1]	11 [0.1]
Gravida	Mean [min - max]	3.2 [1-15]	3.6 [1-16]	3.5 [1 - 16]
Gravida group	One	1182 [26.4]	1380 [20.7]	2562 [23.0]
	Two	813 [18.1]	1116 [16.7]	1929 [17.3]
	Three	692 [15.4]	1091 [16.3]	1783 [16.0]
	More than 3	1785 [39.8]	3048 [45.7]	4833 [43.3]
	Missing	8 [0.2]	40 [0.6]	48 [0.4]
State	Upper Nile	960 [21.4]	280 [4.2]	1240 [11.1]
	Jonglei	320 [7.1]	640 [9.6]	960 [8.6]
	Unity	320 [7.1]	0	320 [2.9]
	Warrap	320 [7.1]	640 [9.6]	960 [8.6]
	Northern Bahr El-Ghazal	320 [7.1]	640 [9.6]	960 [8.6]
	Western Bahr El-Ghazal	320 [7.1]	640 [9.6]	960 [8.6]
	Lakes	640 [14.3]	960 [14.4]	1600 [14.4]
	Western Equatoria	320 [7.1]	1280 [19.2]	1600 [14.4]
	Central Equatoria	640 [14.3]	955 [14.3]	1595 [14.3]
	Eastern Equatoria	320 [7.1]	640 [9.6]	960 [8.6]

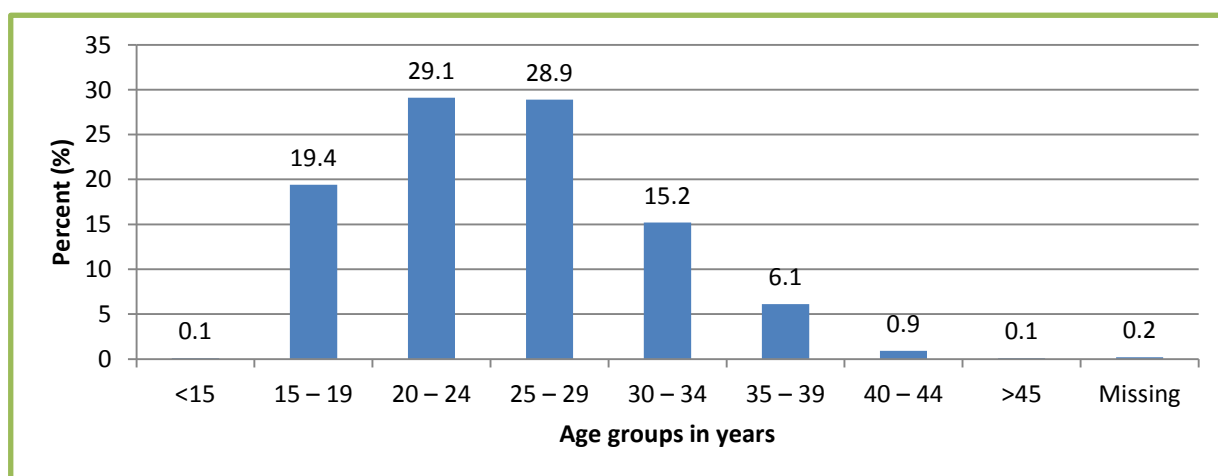
Using the official definition of South Sudan National Bureau of Statistics (NBS) on urban and rural areas, all the sites in state capitals were classified as Urban/Peri-Urban while all the other sites were classified as rural. Majority of participants (n=6675 [60.0%]) were from rural areas, while the remaining 4480 [40%] were from urban/Peri-urban areas. In this round of SS, the majority of the participants were from the Lakes, Western and Central Equatoria states (each, n=1600 [14.4%]). Unity state contributed the least number of participants to the SS (n=320 [2.9%]).

4.1.1. Age distribution

Of all the participants recruited, 11,155 (99.8%) had their ages recorded. The mean age of women attending ANC care in the SS sites was 24.9 years with the youngest and the oldest being 14 and 46years old respectively. There were no substantial differences in age structures between the urban/peri-urban and rural populations (Table 4.1 above).

Figure 4.1.1 below provides an illustration of the age break-down among women participating in the 2012 ANC SS round to highlight the age categories for which the majority of women fall under.

Figure 4.1.1: Distribution of age among women participating in the 2012 ANC SS round



Most participants (n=8,634 [77.4%]) were young women aged between 15 and 29 years old with those aged 20–24 years contributing about a third of all the participants (n=3,244 [29.1%]). 6 the women were aged less than 15 years.

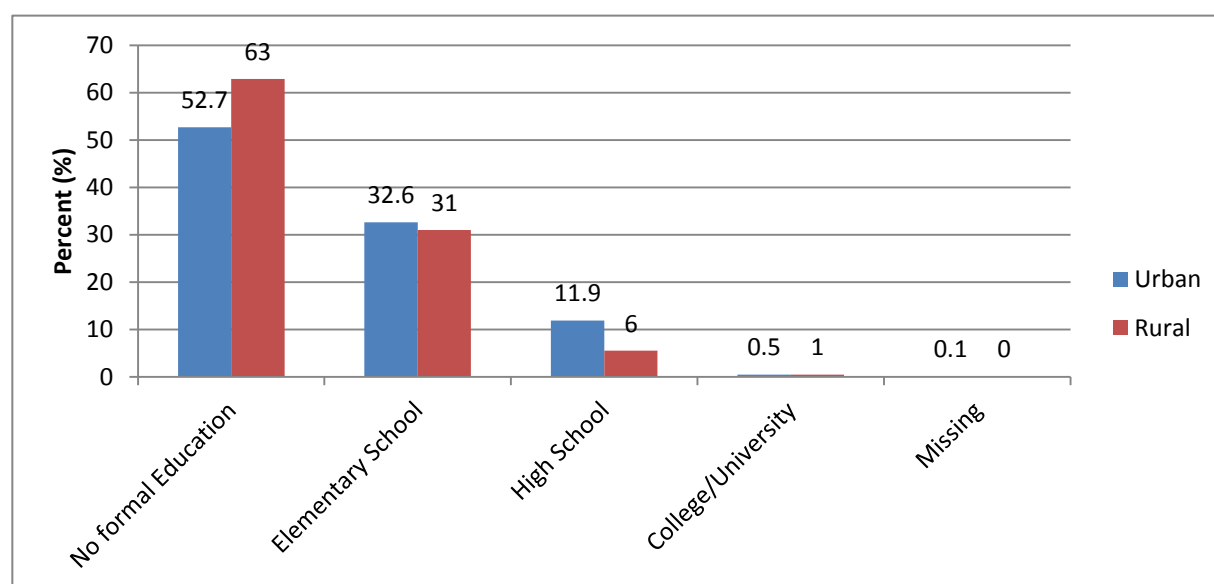
4.1.2. Marital Status

The majority of the women recruited reported to be married with 7,257 (65.1%) women being in monogamous relationships. Generally, rural populations reported a higher proportion of polygamous relationships (1,776[26.5%]) compared to urban (912 [20.4%]) populations. However, there were no other substantial differences in the distribution of marital status between urban, rural and mixed populations. Overall, marital status data was missing in only 1 of the participants.

4.1.3. Education level

More than half of the participants had no formal education (n=6,561 [58.8%]), with participants from rural population having the least levels of education. 63 percent of them had no formal education. Only about 12 percent of participants from urban population and 6 percent of participants from rural population had attained high school education. Overall, data on level of education was missing from 11 (0.1%) of the participants.

Figure 4.1.3: Distribution of education level by residence among women participating in the 2012 ANC SS



4.1.4. Gravidity

The number of pregnancies in women attending ANC and recruited into the SS ranged from 1 to 16 with a mean of 3.5 pregnancies. Women from urban/Peri-urban areas had a higher proportion of being in their first pregnancies (26.4%) compared to women from rural areas (20.7%). On the other hand, women from rural areas had a higher proportion of having more than three pregnancies (3,048 [45.7%]) compared to women from urban (1785 [39.8%]). Overall, 48 (0.4%) of the women had missing data on gravidity.

4.1.5. State

In this round of SS, the majority of the participants were from the Lakes, Western Equatoria and Central Equatoria states (each, n=1600 [14.4%]). Unity state contributed the least number of participants to the SS (n=320 [2.9%]).

4.2 Prevalence and correlates of HIV infection

The overall prevalence of HIV infection in pregnant women from 35 ANC sentinel sites in South Sudan for the year 2012 was 2.6% (95% Confidence Interval, CI: 2.3-2.8). At the site specific level, Ezo reported the highest prevalence of HIV infection at 14% followed by Yambio and Tambura at 8.4% and 6.5% respectively. 11 sites reported less than 1% HIV prevalence with Gokmachar and Kwajok reporting the lowest prevalence of HIV infection at 0% respectively. A detailed description of the site specific SS HIV prevalence is presented in Annex 6.

SS results from 21 (0.2%) participants of the total population recruited were missing. Participants with missing SS results were all from the same sentinel site. Since the proportion of participants missing SS results was so small, subsequent analyses excluded participants with missing SS results. WHO guidelines also recommend ANC SS analysis to be conducted on women aged 15 –49 years. Women aged <15 years and >49 years were hence also excluded from further analysis. In table 4.2 below we provide data on HIV prevalence by select characteristics of ANC SS participants and correlates of HIV infection.

4.2.1. HIV prevalence by age group

Women aged 25 – 29 years old had the highest prevalence of HIV at 2.9% (2.3 – 3.5) while those aged 15 – 19 years old had the lowest percent 1.9 (1.4-2.5). However there were no substantial differences in the prevalence of HIV in pregnant women aged 20 – 24 years and women aged 25 - 29 years (Odds Ratio, OR [95% C.I], p-value: 1 [0.7-1.4] p<0.059).

Table 4.2: Prevalence and correlates of HIV infection among women participating in the 2012 ANC SS (N=11,128)

Characteristics	Categories	Prevalence [95% C.I]	OR [95% C.I]	P-value*
Site location	Urban	2.5 [2-2.9]	Reference	Reference
	Rural	2.7 [2.2-3.1]	1.1 [0.8-1.4]	0.452
Marital Status	Single	5.5 [4.1-6.8]	2.6 [1.9-3.6]	0.000
	Married Monogamous	2.2 [1.8-2.5]	Reference	Reference
	Widowed	4.6 [0.2-9.1]	2.2 [0.8-6.1]	0.128
	Married Polygamous	2.5 [1.9-3.1]	1.2 [0.8-1.5]	0.312
	Divorced	3.8 [0.4-8.2]	1.8 [0.5-5.8]	0.31
Level of Education	No formal Education	1.9 [1.6-2.3]	0.5 [0.4-0.7]	0.000
	Elementary School	3.5 [2.9-4.1]	Reference	Reference
	High School	3.4 [2.3-4.6]	0.9 [0.6-1.4]	0.937
	College/University	3.3 [0.4-6.1]	0.9 [0.3 - 2.3]	0.891
Gravida group	One	1.9 [1.4-2.4]	Reference	Reference
	Two	3.5 [2.7-4.4]	1.8 [1.2-2.6]	0.001
	Three	2.5 [1.7-3.2]	1.2 [0.8-1.9]	0.258
	More than 3	2.5 [2.1-3]	1.3 [0.9-1.8]	0.092
Age Group	<15	No observations		
	15 – 19	1.9 [1.4-2.5]	0.7 [0.5-1]	0.059
	20 – 24	2.8 [2.2-3.4]	Reference	Reference
	25 – 29	2.9 [2.3-3.5]	1 [0.7-1.4]	0.81
	30 – 34	2.5 [1.7-3.2]	0.8 [0.6-1.2]	0.482
	35 – 39	2.5 [1.3 - 3.7]	0.8 [0.5-1.5]	0.665
	40 – 44	1.9 [0.7-4.6]	0.6 [0.2-2.8]	0.598
	>45	No observations		
Syphilis infection	Positive	2.8 [1.7 - 3.9]	1.1 [0.7-1.6]	0.633
	Negative	2.5 [2.2 - 2.9]	Reference	Reference

*Likelihood Ratio Test (LRT) p-value

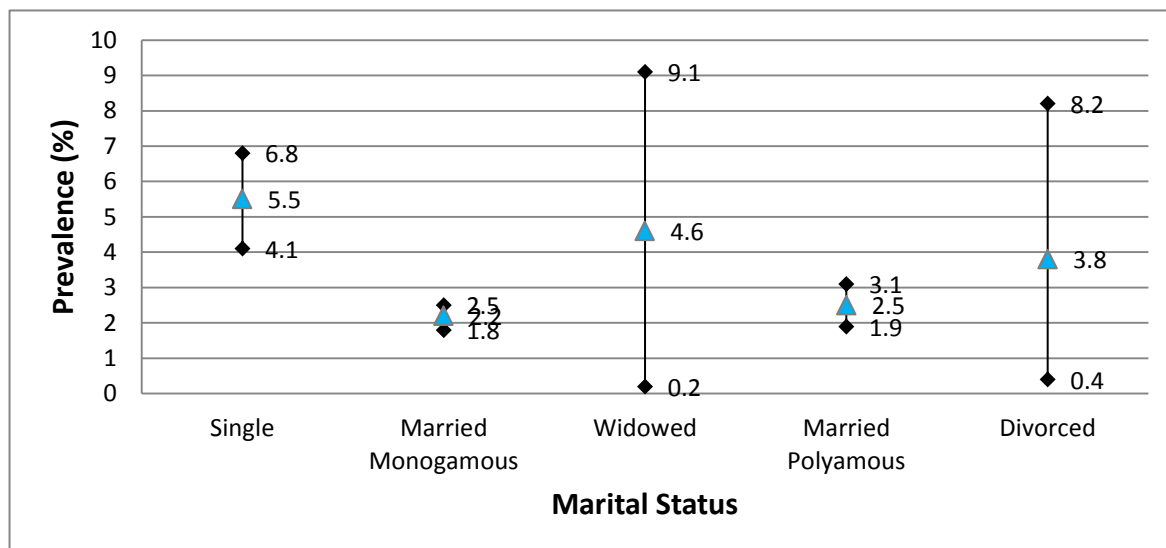
4.2.2. HIV prevalence by site location

There were no substantial differences in the prevalence of HIV in pregnant women attending ANC stratified by locality. However women coming from rural areas had the highest prevalence of HIV 2.7 [2.2-3.1] compared to women from urban/peri-urban 2.5 (2-2.9).

4.2.3 HIV prevalence by marital status

In this round of ANC SS as figure 4.2.3 below show, single pregnant women had the highest prevalence of HIV infection (5.5 [4.1 – 6.8]). Though sample sizes were small for widowed and divorced women, these groups had the second and third highest prevalence of HIV infection (4.6 [0.2 – 9.1]), and (3.8 [0.4 – 8.2]) respectively. Pregnant married women in monogamous relationship had the least prevalence of HIV infection (2.2 [1.9 – 3.1]). Compared to women in monogamous relationships, single women were two and half times more likely to have HIV infection (2.6 [1.9 – 3.6], $p < 0.001$). There were no substantial differences in the prevalence of HIV infection between women in monogamous relationships and those who were widowed (2.2 [0.8 – 6.1], $p = 0.128$).

Figure 4.2.3: HIV prevalence among women participating in the 2012 ANC SS by Marital Status



4.2.4. HIV prevalence by education level

When stratified by level of education, pregnant women with Elementary (primary) education had the highest prevalence (3.5 [2.9 – 4.1]). Compared to those who had attained a primary education, women without a formal education had half the odds of having HIV infection (0.5 [0.4 – 0.7], $p < 0.001$).

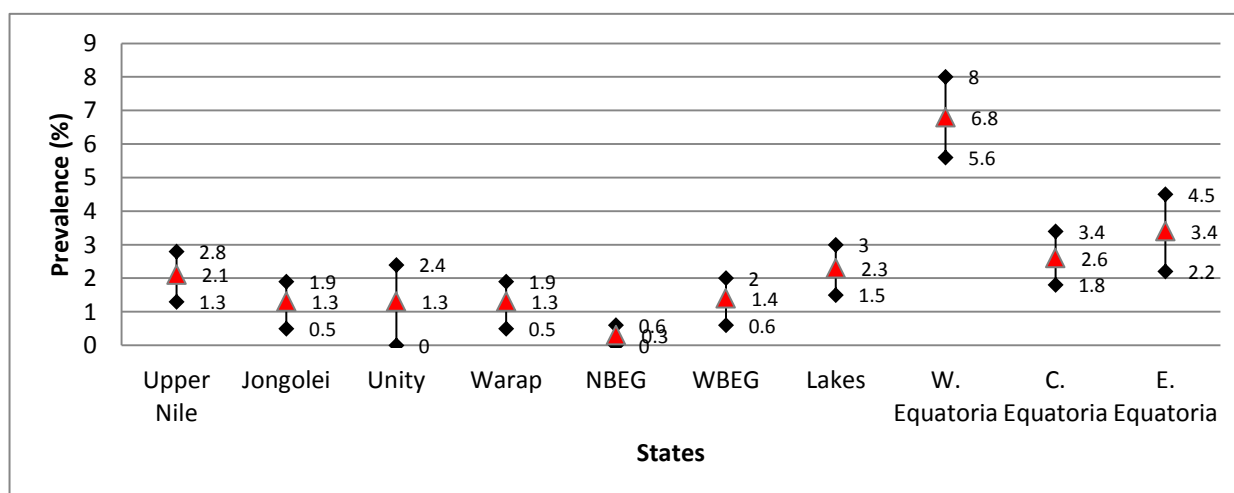
4.2.5. HIV prevalence by gravidity

Results of this round of ANC SS show an increase in the prevalence of HIV infection in women from the first to second pregnancy. However after the second pregnancy the HIV infection prevalence decreases. Women attending ANC care in their second pregnancy had the highest prevalence of HIV infection (3.5 [2.7 – 4.4]) while those in their first pregnancy had the lowest prevalence of HIV infection (1.9 [1.6 – 2.3]). Compared to those who attended ANC care in their first pregnancy, women in their second pregnancy were almost two-fold more likely to have acquired HIV infection (1.8 [1.2 – 2.6], $p < 0.001$). There was no significant difference in the prevalence of HIV infection among women in their third pregnancy compared to those who have had more than three pregnancies (2.5 [1.7 – 3.2] vs 2.5 [2.1 – 3], $p = 0.258$).

4.2.6. HIV prevalence by State

Pregnant women from Western Equatoria had the highest prevalence of HIV infection in the 2012 round of SS in South Sudan at 6.8% (8 – 5.6) followed by Eastern Equatoria (3.4% [2.2 – 4.5]), Central Equatoria (2.6 [1.8 – 3.4]) and lakes state (2.3 [1.5 – 3.4]) as figure 4.2.6 below shows.

Figure 4.2.6: HIV prevalence among women participating in the 2012 ANC SS by State

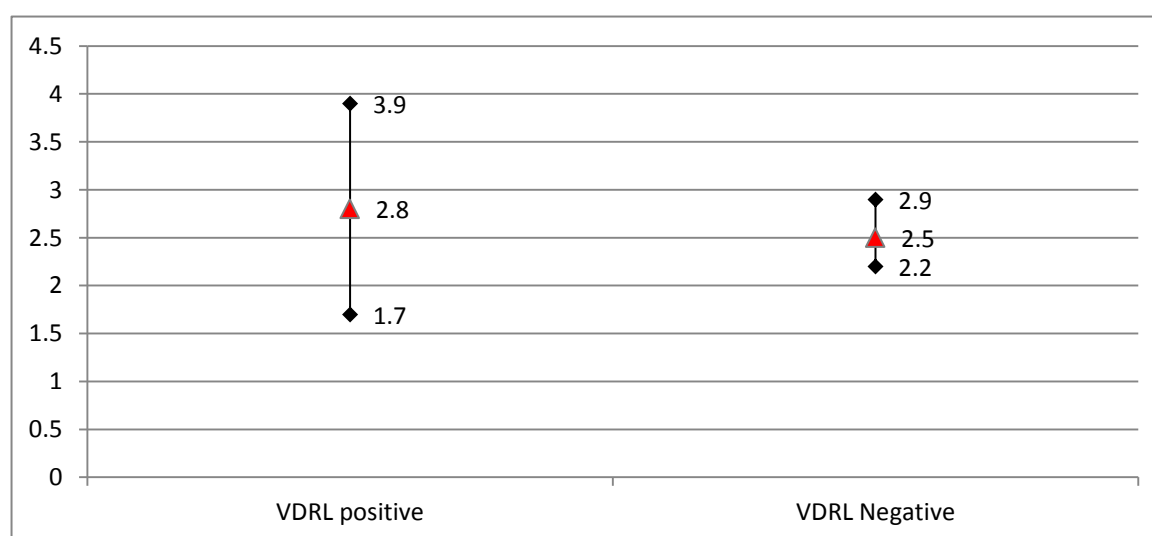


Northern Bahr El-Ghazal reported the lowest prevalence of HIV infection (0.3 [0 – 0.6]) followed by Jonglei (1.3 [0.5 – 1.9]), Unity (1.3 [0 – 2.4]), Warrap (1.3[0.5 – 1.9]) and Western Bahr El-Ghazal (1.4 [0.6 – 2]) states respectively (Figure 4.2.6).

4.2.7 HIV prevalence by syphilis status

Pregnant women who were diagnosed with syphilis infection by VDRL had a HIV prevalence of 2.8% while women without syphilis infection had a HIV prevalence of 2.5%. These data suggest that there was no significant difference in the prevalence of HIV infection among women with syphilis infection compared to those who tested negative for syphilis infection.

Figure 4.2.7: HIV prevalence among women participating in the 2012 ANC SS by syphilis status



4.3 Temporal trends in HIV prevalence

It is difficult to determine trends in HIV prevalence among pregnant women participating in ANC SS over the three rounds conducted between 2007 and 2012. This is mainly because largely different sites participating in the three surveys. For instance out of the 35 sites that participated in the 2012 survey, only 7 of those had participated in the 2007 survey. The sample sizes have also been fluctuating between the different surveys and sites. . Nonetheless, over the past 5 years, the 2012 round of SS had the lowest HIV prevalence among pregnant women since the first round of SS conducted in 2007. A detailed illustration of the site specific prevalence of HIV infection in pregnant mothers for the three surveys is presented in Table 4.3 below.

Table 4.3: HIV prevalence among ANC attendees in the 2007, 2009 and 2012 ANC surveys

	2007 (n=4710)			2009 (n=5913)			2012 (n=11,128)		
	No. Tested	(%) HIV +	95% Confidence interval	No. Tested	(%) HIV +	95% Confidence interval	No. Tested	(%) HIV+	95% Confidence interval
Aweil Civic Hosp				299	0.0	---	320	0.6	0.2 – 1.4
Cueibet PHCC	107	0.9	0.02 - 5.1	300	0.3	0 – 0.98	320	0.6	0.2 – 1.5
Akobo PHCC	110	0.9	0.02 - 5	169	0.6	0 – 0.7	320	1.5	0.2 – 2.9
Kuajok PHCC				289	0.7	0 – 1.6	320	0	
Renk Civic				216	0.9	0 – 2.2	279	1	0.1 – 2.3
Torit Civic				298	1.3	.03 – 2.7	320	2.5	0.7 – 4.2
Wau Teaching				299	1.3	.04 - 2.6	320	0.9	0.1 – 1.9
Bentiu State				296	1.4	.04 - 2.7	320	1.2	0.03 – 2.4
Rumbek PHCC				300	1.7	0.2 - 3.1	317	2.8	1 – 4.6
Leer – PHCC	874	0.8	0.3 – 1.6	135	2.2	0 - 4.7			
KajoKeji Civil	1045	1.6	1.0 - 2.6	264	2.3	0.5 – 4.1	320	2.5	0.7 – 4.2
Maridi PHCC	244	5.7	3.2 - 9.4	250	2.4	0.5 – 4.3	317	4.1	1.9 – 6.3
Boma PHCC	429	7.2	5.0 - 10.1	159	2.5	.08 – 5.0			
Bor Civil Hospital				300	2.7	0.9 – 4.5	320	1.5	0.2 – 2.9
Malakal Hospital				265	3.0	1.0 – 5.1	320	2.5	0.7 – 4.2
St. Bakhitia PHCC	792	2.7	1.6 - 4.0	255	3.1	1.0 – 5.3	320	1.8	0.3 – 3.3
Malakia PHCC				140	3.6	0.5 – 6.6	320	2.8	0.9 – 4.6
Bam PHCC				169	3.6	0.8 – 6.3	320	1.8	0.3 – 3.3
Nyakuron PHCC				300	4.0	1.8 – 6.2	320	3.1	1.2 - 5
Nimule PHCC	492	2.2	1.1 - 4.0	249	5.6	2.8 – 8.5	312	4.4	2.1 – 6.7
Rumbek State				283	5.7	1.0 – 8.3	318	1.2	0.03 – 2.3
Juba Teaching				299	6.0	3.3 – 8.7	319	4.7	2.3 - 7
Pochalla PHCC	18	11.	*						
Tambura PHCC	599	11.	9.1 - 14.4	250	7.6	4.3 – 10.9	320	6.5	3.8 – 9.2
Yambio Hospital				129	15.	9.3 – 21.8	320	8.4	5.4 – 11.5
Katigiri PHCC							314	0.1	0.01 – 2.0
Kapoeta M. Hosp							320	3.1	1.2 - 5
Ezo							319	14	10.3 - 18
Lui Hospital							320	0.9	0.1 – 1.9
Marial Bai							320	0.3	0.3 – 0.9
Gokmachar							320	0	
Raja Civil							320	0.6	0.2 – 1.4
Mapel PHCC							319	2.5	0.7 – 4.2
Tonj South							314	3.5	1.4 – 5.5
Marial Lou							320	0.3	0.3 – 0.9
Wulu PHCC							320	3.1	1.2 - 5
Mapuordit							320	3.4	1.4 – 5.4
Panyagor							320	0.6	0.2 – 1.5
Total	4710	3.7	3.2-4.3	5913	3.0	2.6 – 3.4	11,128	2.6	2.3 – 2.8

4.4 Prevalence and correlates of syphilis infection

The overall prevalence of syphilis as determined by VDRL in pregnant women from 35 ANC SS in South Sudan for the year 2012 was 8.3% [95% Confidence Interval, C.I: 7.6 – 8.6]. At the site specific level, Tonj South reported the highest prevalence of syphilis infection at 37.5% followed by Marial Lou and Rumbek state hospital at 18.8% and 18.6% respectively. Twenty six out of the 35 SS sites reported syphilis prevalence of more than 5%. VDRL results from 117 (1%) of the total population recruited were missing. Since the proportion of participants missing VDRL results was so small, subsequent analyses excluded these participants. Participants' residence (Urban/Peri-urban, Rural), marital status, gravidity and education were all correlated with syphilis infection. Age group in participants showed weak evidence of an association with syphilis infection while level of education was not associated with HIV infection (Table 4.4).

4.4.1. Syphilis prevalence by age group

When stratified by age groups, the highest prevalence of syphilis in pregnant women attending ANC care was 9.4% [8-10.8], observed in the age group of 30 – 34 years old while the lowest prevalence was observed in those aged 15 – 19 years (7.1% [6-8.1]). Compared to women aged 20– 24 years, women aged 30 – 34 years had almost one and a half times the odds of having syphilis (1.3 [1 – 1.5], $p=0.032$).

4.4.2. Syphilis prevalence by residence

Pregnant women coming from rural areas had the highest prevalence of Syphilis infection (9.8 [9-10.5]) while those from Urban/Peri-Urban population had the lowest prevalence of Syphilis infection (5.9 [5.2-6.6]). Compared to those from urban areas, women from rural populations had almost two times the odds of having acquired syphilis infection 1.7 [1.4-1.9], $p=0.000$).

4.4.3. Syphilis prevalence by marital status

Widowed women had the highest prevalence of syphilis infection (12.7 [5.6-19.8]). Followed by married women in polygamous relationships 9.5 [8.4-10.7] and married women in monogamous relationships 8.1 [7.4-8.7]. Single women had about half the odds of having a

syphilis infection compared to married women in monogamous relationships (0.6 [0.5-0.9], $p=0.007$).

Figure 4.4: Prevalence and correlates of syphilis infection among women in the 2012 ANC SS (N=11147)

Characteristics	Categories	Prevalence [95% C.I.]	OR [95% C.I.]	P-value*
Site location	Urban	5.9 [5.2-6.6]	Reference	Reference
	Rural	9.8 [9-10.5]	1.7 [1.4-1.9]	0.000
Marital Status	Single	5.7 [4.3-7.1]	0.6 [0.5-0.9]	0.007
	Married Monogamous	8.1 [7.4-8.7]	Reference	Reference
	Widowed	12.7 [5.6-19.8]	1.6 [0.8-3.1]	0.121
	Married Polygamous	9.5 [8.4-10.7]	1.2 [1-1.4]	0.022
	Divorced	6.5 [0.1-12.1]	0.7 [0.3-1.9]	0.624
Level of Education	No formal Education	10.4 [9.6-11.2]	1.9 [1.6-2.3]	0.000
	Elementary School	5.5 [4.7-6.3]	Reference	Reference
	High School	4.2 [2.9-5.5]	0.7 [0.5-1]	0.12
	College/University	1.3 [0.5-3.2]	0.2 [0.05-0.9]	0.042
Gravida group	One	5.9 [5-6.8]	Reference	Reference
	Two	9.2 [7.9-10.5]	1.6 [1.2-2]	0.000
	Three	9 [7.6-10.3]	1.5 [1.2-1.9]	0.000
	More than 3	8.6 [7.8-9.4]	1.5 [1.2-1.8]	0.000
Age Group	15 – 19	7.1 [6-8.1]	0.9 [0.7-1.1]	0.442
	20 – 24	7.6 [6.7-8.5]	Reference	Reference
	25 – 29	9 [8-9.9]	1.2 [0.9-1.4]	0.052
	30 – 34	9.4 [8-10.8]	1.3 [1-1.5]	0.032
	35 – 39	9.1 [6.9 - 11.2]	1.2 [0.9-1.6]	0.208
	40 – 44	7.8 [2.5-13]	1 [0.5-2.1]	0.945
HIV infection	Positive	9 [5.7-12.3]	1.1 [0.7 - 1.6]	0.633
	Negative	8.2 [7.7-8.7]	Reference	Reference

*Likelihood Ratio Test (LRT) p-value

4.4.4. Syphilis prevalence by education level

When stratified by level of education, pregnant women with no education had the highest prevalence of syphilis infection (10.4% [9.6 – 11.2]). Women with a secondary education and those with college/university education had the lowest syphilis prevalence at 4.2 [2.9 – 5.5] and 1.3 [0.5 – 3.2] respectively. Pregnant women with no formal education had about two times the

odds of having a syphilis infection compared to pregnant women in with Elementary education(1.9 [1.6 - 2.3], $p=0.000$).

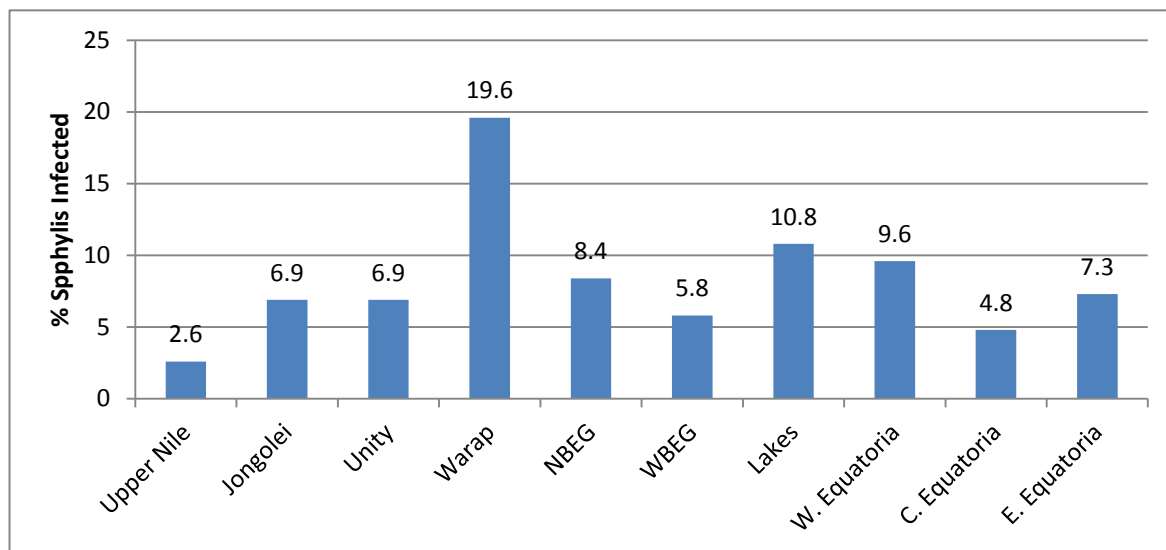
4.4.5. Syphilis prevalence by gravidity

Women with a history of two pregnancies had the highest prevalence of syphilis infection (9.2 [7.9 – 10.5]) while those in their first pregnancy had the lowest prevalence (5.9 [5– 6.8]). Compared to women in their first pregnancy, women with a history of two pregnancies were more likely to have acquired syphilis infection (1.6 [1.2 – 2], $p=0.000$).

4.4.6. Syphilis prevalence by State

Pregnant women from Warrap state had the highest prevalence of syphilis infection in the 2012 round of SS at 19.6% (17 – 22), followed by Lakes Western Equatoria (10.8 [9.3 – 12.4], 9.6 [8.1 – 11]) respectively. Upper Nile and Central Equatoria states reported the lowest prevalence of syphilis infection at 2.6% [1.7 – 3.5] and 4.8 [3.7 – 5.8] respectively.

Figure 4.4.6: Syphilis infection prevalence among women in the 2012 ANC SS by State



4.4.7. Syphilis prevalence by HIV Infection

Pregnant women who were diagnosed with HIV infection had a Syphilis prevalence of 9% [5.7 – 12.3] while women without HIV infection had a HIV prevalence of 8% [7.7 – 8.7].

These data suggest that there was no significant difference in the prevalence of syphilis infection among women with HIV infection compared to those who tested negative for HIV infection.

5.0 Discussion

Approximately three out of every one hundred pregnant women attending ANC in South Sudan were found to be HIV infected while nine out of every one hundred pregnant women were found to be infected with syphilis in the 2012 round of SS. Although there was no conclusive evidence of a significant difference in HIV prevalence among pregnant women participating in ANC SS over the three rounds conducted between 2007, 2009 and 2012. The observed HIV prevalence is the lowest reported in the country since the first round of SS five years ago.

Although several interventions aimed at curbing transmission of HIV infection amongst the adult population have been implemented in last five years, more efforts need to go into establishing evidence-based interventions to realize substantial reduction in the prevalence of HIV infection as outlined in South Sudan National HIV/AIDS Strategic Plan 2013-2017. These interventions include scale up in the promotion of safe sex and provision of condoms, national roll out of Voluntary Medical Male circumcision (VMMC) and scale up provision of ART to benefit those with a CD4 count less than 350. Randomized trials in neighboring countries provide firm evidence that the risk of acquiring HIV is halved by male circumcision [4-6] while provision of ARVs has been shown to decrease the transmissibility of HIV infection by up to 90%.

Although we are unable to show evidence of a decreasing trend in the prevalence of HIV infection in the younger age group (15 – 24 years) over the three time points of SS (raw data for 2007 and 2009 is unavailable), HIV prevalence for this age group in 2012 was 2.5% as compared to 2.9% in 2009. A decline of HIV prevalence in this age group is important as it is suggestive of a decline in HIV incidence (new infections) in our setting. HIV prevalence amongst pregnant women in this age group is more robust and is a key indicator of the MDG and the goals of the UNGASS declaration of commitment on HIV/AIDS [7].

Major variations have been observed in the distribution of HIV prevalence amongst the diverse geographic regions ranging from the highest prevalence of 6.8% in Western Equatoria state and the lowest prevalence of 0.3% in Northern Bahr El-Ghazal. This is a good indication of the socio-economic, cultural and religious diversity in the country. However, the continued high

prevalence of HIV infection in the Equatoria states (Western, Central and Eastern) despite interventions to curb its transmission is of great concern. A better understanding of socio-behavioral and cultural characteristics of these societies residing in these regions is needed to recommend alternative public health interventions and sustained behavioral change.

In other African countries such as South Africa and Kenya [8], the prevalence of HIV infection generally increases with age. This is usually attributed to improved survival rates and quality of life as a result of the scale up of various interventions including the availability of ARV's. However results of the 2012 ANC SS, show that this is not the case in South Sudan. The 25 – 29 age group has the highest HIV prevalence (2.9) while both (30 -34 and 35 – 39) age groups have a HIV prevalence of 2.5 percent. This could be attributed to the fact that the ART program in South Sudan is young and it has not managed to cover all the areas (only 22 sites).

The negative association between HIV and Syphilis prevalence re-affirms the empirical evidence in some countries that syphilis prevalence is not a useful factor to positively correlate with HIV [9]. Hence, an appropriate STI needs to be identified for the co-infection.

6.0 Limitation

Caution should be applied when interpreting these surveillance data. Majority of pregnant women in South Sudan do not attend ANC. According to the 2010 South Sudan Health Survey, only 40% of women were seen at least once by skilled personnel during the antenatal period, and only 11.5% of women delivered at a health facility. Women who do not attend ANC are often more likely to be less literate and coming from rural areas compared to those attending ANC. The prevalence of HIV and syphilis amongst non-attending women is therefore likely to be higher than among those attending ANC, which in our case may have resulted to an underestimation of the prevalence of HIV and syphilis infection.

Exclusion of private clinics is also a limitation in the generalizability of these findings to the country as a whole. Although majority of the women in South Sudan attend public antenatal clinics and the impact of excluding private antenatal clinics may then be negligible, a substantial proportion of women from urban areas may be using private antenatal clinics which may result to a significant difference in HIV and syphilis prevalence.

Given that women of younger age groups (15 – 24 years) are known to engage more in unprotected sex suggesting riskier behavior, the HIV prevalence of 2.5% observed in this population may then be considered to be an overestimate of the prevalence in the general population. Men are also more likely to become infected at an older age than women, hence the prevalence observed cannot be extrapolated to men of similar age group in the general population.

We used univariate analysis to assess correlates of HIV and syphilis infection. Even though the data suggests that all risk factors assessed were correlated with HIV infection, we cannot rule out the possibility of the risk factors having a confounding effect on each other. It is also possible that other risk factors not captured in this analysis may have confounded the effect of the available risk factors on HIV infection. For example, socio-economic status has been found to be an important risk factor for HIV and syphilis infection in our setting.

7.0 Conclusion and Recommendation

South Sudan is the newest state in Africa recovering from a protracted civil war spanning over four decades. The war destroyed the social fabric, physical infrastructure and caused massive displacement of an estimated four million people¹. Given the long period of under-development, the country faces major challenges ranging from establishing peace and stability, developing infrastructure, management of massive population movements, ensuring food security, human resource development, setting governance structures, provision of education, delivery of health and HIV/AIDS services as well as water and sanitation services.

The government knowing that the war against HIV/AIDS pandemic is only starting, will continue to lead the fight. The goal is to reduce new infections by 50% by 2017, Reduction of mortality among men, women and children living with HIV by 50% by 2017, Mother to Child Transmission of HIV reduced from 30% to less than 10% by 2017 and PLHIV on ART increased from 10% (adults) and 3% (children) to 80% (adults) and 50% (children) in need of ART by 2017.

Overall, there is no conclusive evidence that HIV prevalence in South Sudan is declining, consequently there is need to intensify HIV prevention activities especially along the border with Uganda and Democratic Republic of Congo (DRC), Western Equatoria and along the transport corridors. There is need to increase the coverage of prevention services targeted at the youth to ensure a decline in HIV infection rates.

The findings justify the continued collection of age, location/site, level of education, marital status and gravidity data as important risk factors in the assessment of the HIV epidemic.

¹Sudan Development Plan 2011-2013

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Annexes

Annex 1: ANC Site Assessment Tool for HIV Sentinel Surveillance

Date of Site Visit:

Name and Title of Assessor/s:

1. Name of the Facility:

2. Type of Facility:

3. Town:

County:

State:

4. Population of Catchment Area:

5. Person in charge of the Facility: Name:

Position / Title:

Contact Information:

6. Person in charge of the ANC Clinic: Name:

Position / Title:

Contact Information:

7. Does the facility offer the following services?

VCT services:

PMTCT services:

8. ANC Visits (Numbers are to be counted from registers, not from any oral recall. Put the name of the most recent month and go backwards.)

ANC Visit	Last Month	Previous Month	Previous Month	Previous Month
Total ANC Visits				
New (First time clients) ANC Visits				

9. How many of the following health care workers are available for ANC Clinic? (Please put the actual number available, not what exists on paper)

Doctors:

Medical Assistants:

Clinical Officers:

Mid-Wives:

Nurses:

Laboratory Technicians:

Counselors:

Community Health Workers:

Pharmacists:

Pharmacy Assistants:

Others (specify):

10. What services are available for the clients?

a. History:

b. Weight:

c. Physical Examination:

If yes, done by:

d. Laboratory:

e. Immunization:

f. Nutritional Counseling / Micronutrients:

11. Does the facility have a laboratory?

12. If yes, how many people work in the laboratory?

13. Person in Charge of the Laboratory: Name:

Title:

Contact Information:

14. What is the level of training for the laboratory technicians?

15. Does this facility provide any laboratory test to ANC clients as a routine service?

16. If yes, please specify which tests and whether there is equipment to perform the test:

Hemoglobin:

Syphilis:

HIV:

Blood Type:

Others (specify):

17. Is the laboratory specimen drawn in the ANC Clinic?

18. If not, where and how is the client sent to?

19. Is blood drawn on the same day?

20. If not drawn on the same day, when?

21. Is there space for collection of DBS? Storage of DBS?

22. How would DBS specimen be shipped to the reference laboratory?

23. Is treatment for syphilis provided routinely at the site?

24. Any other observation / comments:

Annex 2: List of the 35 SS sites included in the 2012 round by State and site classification

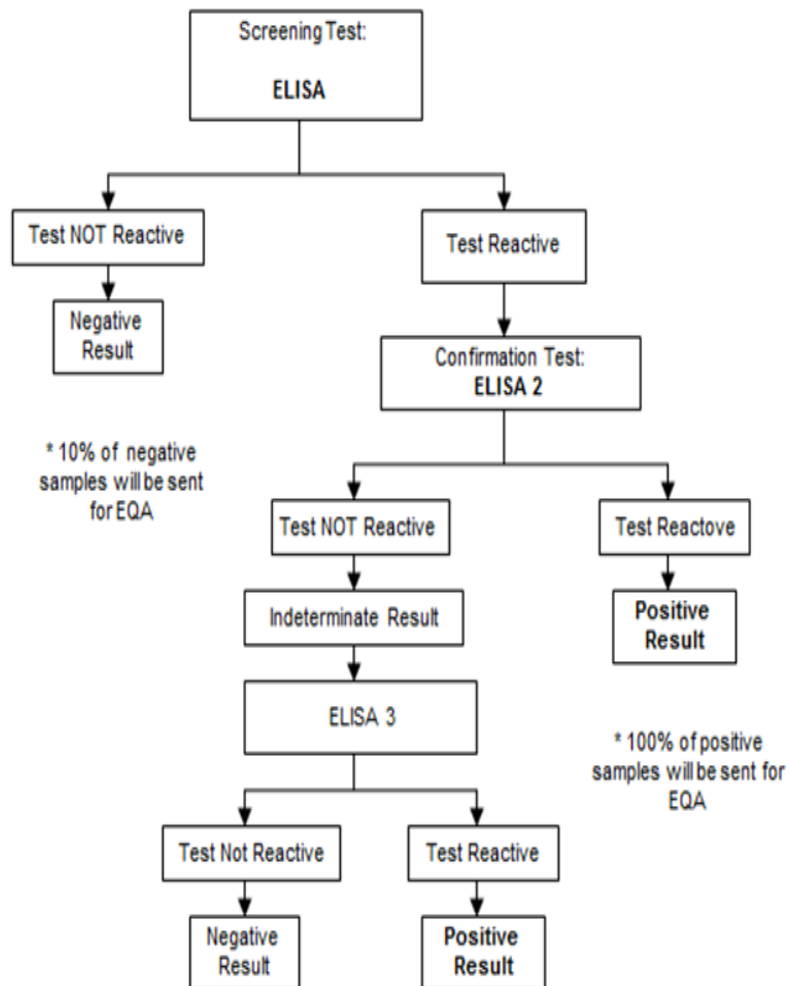
State	Site	Codes				
		State	County	Year	Site no.	Client no.
Upper Nile State	Malakal Teaching Hospital	71	11	12	01	(001-320)
	Malakia PHCC	71	11	12	02	(001-320)
	Bam PHCC	71	11	12	03	(001-320)
	Renk Civil Hospital	71	01	12	04	(001-320)
	Nasir Hospital	71	07	12	05	(001-320)
Jonglei	Bor Civil Hospital	72	11	12	01	(001-320)
	Akobo PHCC	72	07	12	03	(001-320)
	Panyagour	72	10	12	04	(001-320)
Unity State	Bentiu State Hospital	73	04	12	01	(001-320)
	Leer MSF Holland	73	07	12	02	(001-320)
Warrap State	Kuajok Hospital	81	03	12	01	(001-320)
	Tonj South Hospital	81	07	12	02	(001-320)
	Marial Lou	81	05	12	03	(001-320)
Northern BahrelGaz al State	Aweil Civil Hospital	82	05	12	01	(001-320)
	MarialBai	82	04	12	02	(001-320)
	Gokmachar	82	01	12	03	(001-320)
Western BahrelGaz al State	Wau Teaching Hospital	83	03	12	01	(001-320)
	Raja Civil Hospital	83	01	12	02	(001-320)
	Mapel PHCC	83	02	12	03	(001-320)
Lakes	Rumbek State Hospital	84	03	12	01	(001-320)
	Cueibet PHCC	84	01	12	02	(001-320)
	Rumbek PHCC	84	03	12	03	(001-320)
	Wulu PHCC	84	04	12	04	(001-320)
	Mapuordit PHCC	84	06	12	05	(001-320)
Western Equatoria State	Yambio Civil Hospital	91	05	12	01	(001-320)
	Tambura PHCC	91	01	12	02	(001-320)
	Maridi	91	07	12	03	(001-320)
	Ezo	91	04	12	04	(001-320)
	Lui Hospital	91	10	12	05	(001-320)
Central Equatoria State	Juba Teaching Hospital	92	02	12	01	(001-320)
	Nyakuron PHCC	92	02	12	02	(001-320)
	KajoKeji Hospital	92	06	12	03	(001-320)
	St. Bakhita -Yei	92	04	12	04	(001-320)
	Katigiri PHCC	92	02	12	05	(001-320)
Eastern Equatoria State	Torit Civil Hospital	93	01	12	01	(001-320)
	Nimule Hospital	93	08	12	02	(001-320)
	Kapoeta Mission Hospital	93	05	12	03	(001-320)

ANC LABORATORY REQUEST FORM		
Patient ID number:	<div style="border: 1px solid black; width: 200px; height: 25px;"></div>	
: _____ Age _____ (yrs)	Gravida/Parity: ____/____	
e: _____ Payam: _____	County: _____	
Marital Status: <input type="checkbox"/> Single <input type="checkbox"/> Married, monogamous <input type="checkbox"/> Married, polygamoous <input type="checkbox"/> Separated or Divorced <input type="checkbox"/> Widowed <input type="checkbox"/>		
First ANC visit? Yes <input type="checkbox"/> No <input type="checkbox"/>		
Brief clinical history: _____		
Investigation requested: _____ by: _____ (signature)		
Blood:	<input type="checkbox"/> HB <input type="checkbox"/> Syphilis <input type="checkbox"/> B/S for parasites <input type="checkbox"/> Other (specify): _____	
Stools:	<input type="checkbox"/> direct microscopy <input type="checkbox"/> other (specify: _____)	
Urine:	<input type="checkbox"/> microscopy <input type="checkbox"/> chemistry (glucose / protein only) <input type="checkbox"/> chemistry (all parameters) <input type="checkbox"/> pregnancy test	
Other(specify): _____		
Result: _____		
NOTIFY CLINICIAN OF RESULT IMMEDIATELY <input type="checkbox"/>		
Date: ____/____/____	Examined by: _____ (signature)	

Annex 4: ANC Sentinel Surveillance Form

SOUTHSUDAN SENTINEL SURVEILLANCE 2011	
Data Collection Form	
SOCIO-DEMOGRAPHIC DATA	
<p>1. Site : _____ 2. Identification Code : (Stick number)</p> <p>3. Collection date:/...../..... 4. Age (years) : _____</p> <p>5. Gravidity (# pregnancies): _____ 6. Parity (# full-term births): _____</p> <p>7. Marital Status : <input type="checkbox"/> Married <input type="checkbox"/> Divorced <input type="checkbox"/> Widowed <input type="checkbox"/> Single</p> <p>8. Usual place of residence: _____</p> <p>9. Was woman offered PMTCT HIV testing? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> No PMTCT at site</p> <p>10. Did woman accept PMTCT HIV testing? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't know</p> <p>11. Result of the syphilis test at site level : Positive /___/ Negative /___/</p> <p>12. Lab staff initials: _____</p>	

Annex 5: HIV Testing Algorithm



Annex 6: Site specific HIV and Syphilis Prevalence (%) among women in the 2012 ANC SS (N=11,128)

Sites	HIV Prevalence [95% C.I]	Syphilis Prevalence [95% C.I]
Juba Teaching Hospital	4.7 [2.3-7]	4.2 [1.9-6.4]
Nyakuron PHCC	3.1 [1.2-5]	3.1 [1.2-5]
KajoKeji Hospital	2.5 [0.7-4.2]	8.1 [5.1-11]
St. Bakhita -Yei	1.8 [0.3-3.3]	6.3 [3.6-9]
Katigiri PHCC	0.1 [0.01-2.0]	2.2 [0.5-3.8]
Torit Civil Hospital	2.5 [0.7-4.2]	7.5 [4.6-10.3]
Nimule Hospital	4.4 [2.1.6-7]	3.1 [1.2-5]
Kapoeta Mission Hospital	3.1 [1.2-5]	11.6 [8-15]
Yambio Civil Hospital	8.4 [5.4-11.5]	10.6 [7.2-14]
Tambura PHCC	6.5 [3.8-9.2]	5 [2.6-7.4]
Maridi	4.1 [1.9-6.3]	12.5 [8.8-16]
Ezo	14 [10.3-18]	11.3 [7.7-14.7]
Lui Hospital	0.9 [0.1-1.9]	8.8 [5.6-11.8]
Aweil Civil Hospital	0.6 [0.2-1.4]	12.2 [8.5-15.7]
MarialBai	0.3 [0.3-0.9]	0.9 [0.1-2]
Gokmachar	0	12.4 [8.7-16]
Wau Teaching Hospital	0.9 [0.1-1.9]	4.4 [2.1-6.6]
Raja Civil Hospital	0.6 [0.2-1.4]	7.2 [4.3-10]
Mapel PHCC	2.5 [0.7-4.2]	5.9 [3.3-8.5]
Kwajok Hospital	0	2.8 [0.9-4.6]
Tonj South Hospital	3.5 [1.4-5.5]	37.5 [32-42]
Marial Lou	0.3 [0.3-0.9]	18.8 [14.5-23.1]
Malakal Teaching Hospital	2.5 [0.7-4.2]	0.6 [0.2-1.5]
Malakia PHCC	2.8 [0.9-4.6]	2.5 [0.7-4.2]
Bam PHCC	1.8 [0.3-3.3]	3.4 [1.4-5.4]
Renk Civil Hospital	1 [0.1-2.3]	4 [1.6-6.3]
Rumbek State Hospital	1.2 [0.03-2.4]	18.6 [14-23]
Cuiebet PHCC	0.6 [0.2-1.5]	10.6 [7.1-14]
Rumbek PHCC	2.8 [1-4.6]	1.7 [0.2-3.1]
Wulu PHCC	3.1 [1.2-5]	15.3 [11.3-19.2]
Mapourdit PHCC	3.4 [1.4-5.4]	8.4 [5.3-11.4]
Bentiu State Hospital	1.2 [0.03-2.4]	6.9 [4.1-9.7]
Bor Civil Hospital	1.5 [0.2-2.9]	5.6 [3.1-8.1]
Akobo PHCC	1.5 [0.2-2.9]	9.1 [5.9-12.2]
Panyagour	0.6 [0.2-1.5]	6.3 [3.5-8.9]